

ROLE OF SHIRODHARA IN MODULATING NEURODEVELOPMENTAL DISORDERS IN CHILDREN

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ABSTRACT

Neurodevelopmental disorders are disabilities associated primarily with the functioning of the neurological system and brain. These disorders typically manifest in early childhood, frequently persist into adulthood, and impose substantial limitations on personal, social, academic, and occupational functioning. Considering the chronic course and profound functional limitations associated with neurodevelopmental disorders, there is a growing emphasis on integrative and complementary therapeutic approaches. *Shirodhara*, a classical *Ayurvedic* therapy is traditionally recognized for its tranquilizing and stabilizing influence on the central nervous system. It is postulated to exert regulatory effects on neuroendocrine mechanisms, mitigate stress responses, improve sleep architecture, and enhance cognitive and behavioral modulation. Accordingly, *Shirodhara* may be

regarded as a valuable adjunctive modality within the holistic management framework of neurodevelopmental disorders.

KEYWORDS: Neurodevelopmental Disorders, *Ayurvedic* therapy, *Shirodhara*.

INTRODUCTION

Neurodevelopmental disorders are types of disorders that influence how the brain functions and alter neurological development, causing difficulties in social, cognitive, and emotional functioning. These disorders usually start in childhood and affect how the brain works, impacting learning, behavior, and emotions. More prevalent in males than females.^[1] WHO

defines the NDD criteria “behavioural and cognitive disorders that arise during the developmental period that involve significant difficulties in the acquisition and execution of specific intellectual, motor, or social functions.”^[2] It is also common for an individual to be diagnosed with multiple neurodevelopmental disorders. In one study of children between 7 and 12 who had mental health conditions, 55% had a neurodevelopmental disorder.^[3] Epigenetics is an important factor in the development of conditions like NDs. Epigenetics is when an individual’s environment and behavior can alter DNA and how genes operate within the body. Early childhood experiences, like trauma, neglect, or toxic environments, have recently been acknowledged as a prime risk factor in developing certain disorders, including NDs. According to the American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* (DSM-5) published in 2013, these conditions generally appear in early childhood, usually before children start school, and can persist into adulthood.^[4] There are many different types of NDs, below are a few of the most prevalent ones;

- Attention-deficit/hyperactive disorder (ADHD)
- Autism spectrum disorder (ASD)
- Cerebral palsy
- Communication disorders
- Conduct disorders
- Intellectual disabilities
- Learning disorders

Attention-Deficit Hyperactivity Disorder

It is a disruptive behavior disorder characterized by symptoms of inattention and hyperactivity-impulsivity, occurring in several settings and more frequently and severely than is typical for other individuals in the same stage of development.^[5]

Table 1: Symptoms of Hyperactivity, Impulsivity, Inattention.^[6]

S. No.	Core Symptoms	
1.	Hyperactivity	Excessive fidgetiness (e.g. tapping hands or feet and squirming in seat) Difficulty remaining still when sitting is expected (e.g. at dinner, school, etc.) Excessive talking and difficulty playing quietly Run around a lot, always "on the go".
2.	Impulsivity	Impatient, difficulty waiting turns, interrupt conversations, or others' activities Blurt out inappropriate statements/answers too quickly Express emotions without restraint

		Act without considering consequences.
3.	Inattention	Easily distractible, frequently switch from one task to another, and forgetfulness in routine activities Difficulty in focusing on organizing and completing an activity Avoids tasks that require consistent mental effort Gets easily bored, unless doing some enjoyable activity Misses details, makes careless mistakes, often loses belongings (e.g. pencils, toys, and books) Seems not to listen when spoken to Have difficulty in following instructions as quickly and accurately as others

2. AUTISM SPECTRUM DISORDER

This disorder characterized by persistent deficits in social communication and interaction, and presence of repetitive, restricted pattern of behaviors, interests, and activities.^[7]

DSM-5 criteria described core clinical features of ASD under two domains.^[8]

Table 2.

Deficits in social communication and social interaction	
Social communication	Abnormal or impaired initiation of social interaction Impaired social imitation Failure of normal back-and-forth conversation Indifference to other's emotions Reduced sharing of achievements
Social interaction	Poor eye contact Impaired joint attention Inability to understand and use gestures Exaggerated or decreased facial expressions

Table 3.

Presence of restricted, repetitive patterns of behavior, interests or activities.	
Stereotyped or repetitive speech, motor movements	Echolalia Repetitive vocalizations Lining of toys or spinning of wheels
Insistence on sameness	Inflexible adherence to routines and rituals
Highly restricted and fixated interests	Preoccupation piece of paper or toffee wrappers Inflexible interest in certain activities/objects like a puzzle, or cartoon character
Hyper or hypo reactivity to sensory inputs	Pain insensitivity Sound hypersensitivity Unusual interests in sensory aspects like smelling of objects, visual fascination with mirrors

SHIRODHARA IN NEURODEVELOPMENTAL DISORDERS

Shirodhara is an *Ayurvedic* method of treatment in which herbal oil, medicated milk or decoction is poured gently and steadily over forehead in a continuous stream at a particular point from a definite height. It is a body purification process that removes anxiety, stress, and any unwanted effects on the central nervous system along with eliminating the body's toxins. It is a non-invasive procedure which has shown satisfactory results in reducing the core symptoms of ADHD. Singhal et al (2010) conducted investigation to evaluate the increase in attention span in 43 ADHD-affected children treated with different *Ayurvedic* approaches.

Possible Mode of Action of *Shiro-Dhara*

In *Ayurvedic* understanding, the forehead represents the seat of *Prana Vata*, the vital subtype of *Vata* responsible for governing higher mental functions, cognition, and the integration of sensory inputs. In neurodevelopmental disorders, vitiation of *Prana Vata* manifests as hyperactivity, agitation, impaired attention, and sensory hypersensitivity. *Shirodhara* through its continuous and rhythmic pouring of warm medicated liquids, provides a soothing and harmonizing stimulus that pacifies the vitiated *Prana Vata*. This targeted intervention facilitates the restoration of neurological equilibrium, promoting mental calm, reducing behavioral dysregulation, and enhancing the child's capacity for adaptive sensory and cognitive processing.

On other hand, the forehead is also intimately associated with *Tarpaka Kapha*, which sustains mental stability, memory consolidation, and the clarity of intellect. Thus by delivering *Snigdha* and *Sheeta* qualities to the *Shiras*, this therapy replenishes and nourishes *Tarpaka Kapha*. This nourishment supports the optimal functioning of *Medha* and *Smriti*, facilitating improved attention, learning capacity, and cognitive performance.

Tranquilizing effect: During procedure, particular pressure and vibration is created over the forehead. The vibration is amplified by the hollow sinus present in the frontal bone. The vibration is then transmitted inwards through the fluid medium of cerebrospinal fluid. This vibration along with little temperature may activate the functions of thalamus and the basal fore brain, which then brings the amount of serotonin and catecholamine to the normal stage inducing the sleep.^[9] It may stimulate the forebrain and produce improvement in behavior, concentration and intelligence.

Modulation of the Autonomic Nervous System

Shirodhara may exert a modulatory influence on the autonomic nervous system through continuous, rhythmic stimulation of the glabellar region. Such stimulation may engage trigeminal afferent pathways that communicate with autonomic regulatory centres within the brainstem, potentially promoting parasympathetic activity and attenuating excessive sympathetic arousal. In children with NDDs, this autonomic shift may contribute to reduced hyperarousal and irritability, along with improvements in attention, emotional regulation, and stress tolerance. By facilitating a state of physiological relaxation and enhancing parasympathetic tone, *Shirodhara* may support emotional stability and adaptive behavioural responses.

Regulation of Hypothalamic-Pituitary-Adrenal Axis

The therapy also influences neuroendocrine function through the hypothalamic-pituitary-adrenal axis. Chronic stress and elevated cortisol are common in children with NDDs, contributing to sleep disturbances, emotional dysregulation, and cognitive impairments. *Shirodhara* has been associated with reduced cortisol secretion, enhanced serotonin and melatonin regulation, and stabilization of circadian rhythms. These neuroendocrine adjustments improve sleep quality, decrease anxiety and aggression, and create a more conducive neurobiological environment for learning and behavior modulation.

Modulation of Cortical Activity and Brain Waves

EEG evidence suggests that *Shirodhara* may increase alpha-wave activity, indicative of a state of relaxed alertness, while attenuating excessive beta activity associated with anxiety and hyperarousal. Altered cortical excitability in children with ADHD and autism may contribute to attentional difficulties and sensory overload. By promoting greater stability of cortical rhythms, *Shirodhara* may enhance attention, sensory processing, cognitive functioning, and impulse regulation, potentially supporting improved functional outcomes.

Modulation of Limbic System and Emotional Regulation

This procedure may influence the limbic system, particularly the amygdala and hippocampus, which play key roles in emotional processing and memory. Through potential effects on neurotransmitter pathways, especially serotonergic and GABAergic mechanisms, it may help reduce excessive limbic reactivity. In children NDDs, these effects may contribute to better emotional regulation, reduced anxiety and fear responses, fewer behavioral outbursts, and improved social interaction, thereby supporting overall psychosocial functioning.

CONCLUSION

Shirodhara emerges as a promising complementary therapy for children with neurodevelopmental disorders, offering a holistic approach that may influence physiological, emotional, cognitive, and behavioral domains. It is a purifying and rejuvenating therapy which promote relaxation, regulate stress responses, support restorative sleep, and enhance attention and emotional control provides a compelling basis for its therapeutic application. The proposed modulation of autonomic, neuroendocrine, cortical, and limbic functions further suggests that its benefits may extend beyond symptomatic relief to support overall neurobehavioral well-being. As a gentle, non-invasive intervention, therefore serve as a valuable adjunct to conventional multidisciplinary care, with the potential to improve adaptive functioning and quality of life in affected children.

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